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Vascular Flora of the Rocky Fork Tract, Tennessee, USA, and Its Use in Conservation and Management

THE VASCULAR FLORA OF THE ROCKY FORK TRACT, TENNESSEE, U.S.A., AND ITS USE IN CONSERVATION AND MANAGEMENT

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ABSTRACT

A flora of the 3800 ha Rocky Fork Tract in northeast Tennessee produced 749 species of which 19 were on the Tennessee Rare Plant List and 34 were on the Cherokee National Forest Species Viability List with 87 county records from Greene County and 217 from Unicoi County. Rare species were particularly numerous in the Cyperaceae and Orchidaceae. The tract serves as a refuge for several regionally uncommon species by supporting either large populations or metapopulations of these species. Exotic species comprised 15% of the flora and were most common in the Fabaceae and Poaceae. The most unique habitat was a heath bald dominated by *Rhododendron catawbiense* with abundant *Xerophyllum asphodeloides* in the herbaceous layer. While species richness was relatively high compared to regional sites of comparable area, diversity was limited by the absence of high elevation spruce-fir communities and the paucity of wetlands.

Key Words: Rocky Fork, conservation, disjunct, flora, exotics, rare species, refuge, species richness

RESUMEN

Una flora realizada en las 3800 ha de Rocky Fork Tract en el noreste de Tennessee dio como resultado 749 especies de las que 19 estaban en la Rare Plant List deTennessee y 34 en la Cherokee National Forest Species Viability List, con 87 citas del condado de Greene County y 217 del condado Unicoi. Las especies raras fueron particularmente numerosas en Cyperaceae y Orchidaceae. Esta extensión sirve como refugio a varias especies poco frecuentes en la región teniendo tanto poblaciones amplias como metapoblaciones de estas especies. Las especies exóticas fueron el 15% de la flora y las más comunes pertenecieron a Fabaceae y Poaceae. El hábitat más exclusive fue un brezal dominado por *Rhododendron catawbiense* con abundante *Xerophyllum asphodeloides* en el estrato herbáceo. Mientras que la riqueza en especies fue relativamente alta comparada con los lugares de la región con áreas comparables, la diversidad estuvo limitada por la ausencia de grandes elevaciones con comunidades de abetos y la escasez de humedales.

INTRODUCTION

The 3800 ha Rocky Fork Tract in Greene and Unicoi Counties, Tennessee, is a largely forested area bordered by the Pisgah and Cherokee National Forests, the Sampson Mountain Wilderness, and on the low elevation periphery, small acreages of private land and public roads (Fig. 1). Although privately owned prior to 2009, since the mid-20th century the tract was leased to the State of Tennessee, open to the public, and managed by the Tennessee Wildlife Resources Agency. The entire tract was a black bear reserve and the upper reaches and headwater feeder streams of Rocky Fork Creek were managed for naturally-reproducing brook trout with the lower reaches managed for and stocked with rainbow trout. In 2009, the U.S. Forest Service (USFS) ranked the tract as its highest national priority for acquisition (Appalachian Trail Conservancy 2012), because it is largely surrounded by other federally-owned properties and encompasses intact watersheds.

Climate, Geology, and Soils

Rocky Fork is situated in a moist temperate climate. Erwin, Tennessee, the nearest city with available climate data, has an average annual rainfall and snowfall of 114 cm and 23 cm, respectively (U.S. Climate Data 2016). November is the driest month with an average of 7.2 cm of precipitation and July the wettest with 14.1 cm. January is the coldest month with average low and high temperatures of -2.9 C and 8.3 C, respectively, and July the warmest with average lows and highs of 17.8 C and 27.9 C, respectively. However, these are lower estimates for precipitation and higher estimates for temperatures because Erwin is in a valley at an elevation of 510 m while the elevation range in the tract is 655–1475 m.

The Rocky Fork Tract encompasses part of the western margin of the Unaka Mountain Range of the Blue

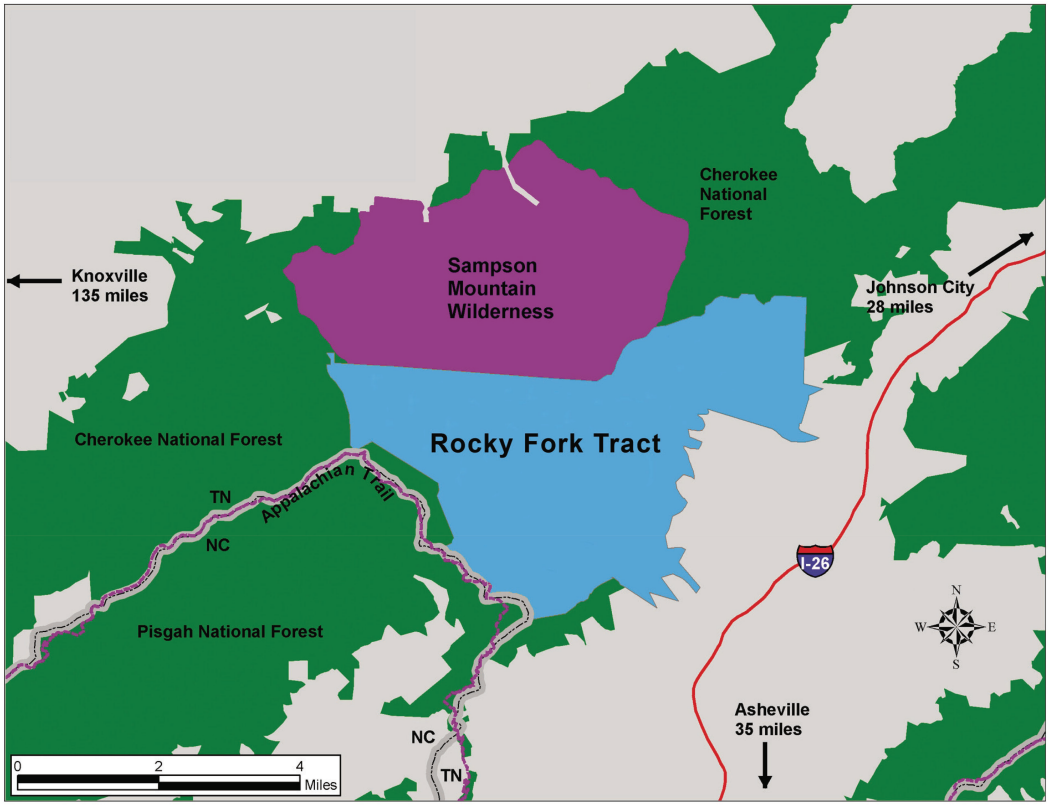

Fig. 1. Map showing the Rocky Fork Tract and the surrounding region (reproduced with permission from the Appalachian Trail Conservancy).

Ridge physiographic province (Rogers 1953). The Pre-Cambrian bedrock is comprised primarily of granite and gneiss. Flint Mountain, on the southeastern side of the tract, is underlain by sandstone and quartzite with argillaceous shale and quartz conglomerate in the lower slopes. Much of the remainder of the Rocky Fork Creek watershed is dominated by coarse sandstone and fine conglomerate with lesser components of shale and siltstone on the lower slopes. On the western portion of the tract, Rich Mountain, a member of the Ridge and Valley physiographic province, is comprised of sandstone and shale.

Lower Higgins Creek, Rocky Fork Creek, and to a lesser extent, Edwards Branch, drain the majority of the area of the tract. All are tributaries of South Indian Creek which flows into the Nolichucky River in Erwin, TN. Moderate to steep slopes characterize the tract which has its lowest elevations at Lower Higgins Creek (792 m) and Rocky Fork Creek (655 m) and which are also the only two paved road access points. The highest elevation (1475 m) is at Big Butt peak near the northwest corner of the tract and along the North Carolina border (Fig. 1). The Appalachian Trail parallels the state line and the boundary of the tract except for a new, five-kilometer section that extends into the tract via Snakeden Ridge. Other high points are in the interior at Wilson Knob (1399 m) and Frozen Knob (1305 m).

Soils of the Ditney-Maymead-Brookshire Group cover much of the tract (Soil Conservation Service 1985). Derived primarily from quartzites, sandstones and shales, these well-drained loams occur on steep slopes. Ditney Loam tends to occupy lower and south-facing slopes below 1000 m, Maymead Loam is in coves and at higher elevations, and Brookshire Loam can be found in the Higgins Creek drainage in coves and at the base of slopes. The stony, quartzite-derived soils of the Jeffrey series occur on the upper slopes of Flint Mountain and

Higgins Ridge. Ramsey Stony Loams dominate the higher elevations in Greene County, including the Ball Ground (Soil Conservation Service 1958). All of these soils are classified as acid to strongly acid with pH of 4.5–5.5. Less acidophilic vegetation is apparent on the more neutral Ashe Loam (pH = 5.1–6.0), which occurs in small pockets on some of the lower slopes adjoining Rocky Fork Creek and Lower Higgins Creek.

History and Vegetation

Despite a history of wildlife management, the Rocky Fork Tract is far from pristine as timber harvest was ongoing until all but 40 ha was purchased by The Conservation Fund in phases from 2009–2012. The remaining 40 ha, which includes a heath bald at 1463 m was purchased in 2015. The areas most highly impacted by logging since 1990 are the upper reaches of the Flint Creek watershed and much of the Blockstand Creek watershed, two major tributaries of Rocky Fork Creek. During this period, an unintentional fire damaged the headwater regions of Long Branch and Big Branch resulting in a depauperate herbaceous layer. Less evidence of disturbance is found in the headwaters of Rocky Fork Creek and its other major tributaries, Ft. Davie Creek and Broad Branch, and in the Lower Higgins Creek watershed. Although the intensity of disturbance varies across the site, the land use history has created a forest devoid of old growth and exceptionally large trees. Moreover, approximately 30 km of unimproved roads traverse the tract. There has been no modern human habitation in the upper reaches and none in the lower reaches since the mid-20th century. Further, there was no clearcut logging, so the forest is largely intact and unbroken except for dirt and gravel roads.

Vegetation of the tract is largely mid-successional mesic deciduous forest. As the tract has no unusual geologic or soil types, a brief description of the forest communities is sufficient. Moist coves and north slopes are dominated by *Aesculus flava*, *Betula alleghaniensis*, *Fagus grandifolia*, *Liriodendron tulipifera*, and *Quercus rubra*, with *Acer pensylvanicum* and *Magnolia fraseri* common in the sub-canopy. Prior to devastation by the hemlock woolly adelgid, *Tsuga canadensis* dominated some lower slopes and coves. Drier slopes are dominated by *Acer rubrum*, *Carya glabra*, *Nyssa sylvatica*, *Quercus coccinea*, and *Q. montana*, with *Amelanchier laevis*, *Cornus florida*, and *Oxydendrum arboreum* in the sub-canopy. In addition to the latter suite of species, narrow ridges, while limited in extent, support *Pinus pungens* and *P. rigida* with *Eubotrys recurva*, *Gaultheria procumbens*, *Gaylussacia baccata*, *Lyonia ligustrina*, *Robinia hispida*, *Vaccinium pallidum*, and *V. stamineum* in the understory. A unique bald community occurs downslope from Big Butt at the Ball Ground. Here, *Rhododendron catawbiense* forms a canopy with an abundance of *Xerophyllum asphodeloides* in the understory. Surrounding vegetation includes *Acer spicatum*, *Sorbus americana*, and *Viburnum lantanoides*, with *G. baccata* and *V. altomontanum* in openings. Rock outcroppings large enough to be in full sun are rare but a few occur on Snakeden Ridge, on the south-facing slope of Higgins Ridge, on the south-facing slope above Rocky Fork Creek upstream of the mouth of Flint Creek, and at Whitehouse Cliffs near the main gate on Rocky Fork Creek.

In 2012, 824 ha encompassing the lower reaches of Rocky Fork Creek, were transferred to the State of Tennessee and now comprise Rocky Fork State Park. The remainder is now part of the Cherokee National Forest. With the change in ownership and new priorities for management, a transition in usage has already occurred away from extractive activities and towards increased recreational use. For example, a visitor's center and campground are planned for the park, an extensive trail system is currently under development, a five kilometer re-route of the Appalachian Trail down Snakeden Ridge has been completed, and new land use prescriptions will be applied on USFS property.

After acquisition by federal and state agencies, but prior to development, there was a window of time which provided an opportunity to examine the flora prior to development of the state park and management of the remainder by the USFS. Consequently, this study was conducted to compile a voucher-based comprehensive flora of the Rocky Fork Tract. The flora provides a historical record that will facilitate analyses of the losses and gains that occur after development and under new management. In a more immediate application, the flora can be used to help guide decisions on placement of roads, trails, campsites, etc., to minimize impacts to significant habitats and noteworthy floristic elements. In addition to documenting the flora, we highlight noteworthy habitats and floristic elements, note potential serious threats to the flora, and use these data to offer recommendations for conservation and management of the flora.

METHODS

A total of 108 collecting trips were taken between March 2009 and October 2015. The bulk of these trips occurred from 2009–2011 (21, 28, and 31 trips respectively in 2009, 2010, and 2011) during which time trips were taken at least once per month but usually two to five times per month during the growing seasons. A total of 3150 specimens were collected and deposited in the East Tennessee State University John C. Warden Herbarium (ETSU). Completeness of the vascular plant collection was assessed using a species accumulation curve and using a concurrent survey of Rocky Fork bryophytes for comparison (Smucker 2016). Collection permits were secured from appropriate state and federal agencies. Plant nomenclature follows Weakley et al. (2012) and is supplemented by Chester et al. (2015) for taxa not present in or recognized by the *Flora of Virginia*.

Range disjunctions were designated as either local, defined as species with no records in the eight counties that comprise upper east Tennessee (First Tennessee Development District) or regional, defined as species with no Tennessee records north of the Smoky Mountains (Cocke County) or east of the Cumberland Plateau. Maps from the online Atlas of the Tennessee Flora (University of Tennessee Herbarium) were consulted for state county distributions and BONAP (Kartesz 2015) was consulted for ranges outside Tennessee.

Using the summary presented by Klahs (Table 11 in Klahs 2014), a double log species-area curve was plotted using data for other regional sites encompassing areas at least one order of magnitude smaller and larger than Rocky Fork. Sites with unusual geologic or soil characteristics were not included because these can either be species rich (e.g., amphibolites) or depauperate (e.g., ultramafics) whereas the Rocky Fork Tract has none of these features.

RESULTS

There were 749 vascular plant species representing 110 families in the Rocky Fork Tract of which 87 were records for Greene County and 217 for Unicoi County (Appendix). Based on the leveling of the species accumulation curve, sampling appears to have been adequate. The species accumulation curve has a steep slope for the collecting trips of the first year (trips 1–21), accounting for 501 species (Fig. 2). During the second year (trips 22–49), the slope is less steep and that period ended with a cumulative total of 601 species. The curve then flattens over the third year (trips 50–80) at the end of which the cumulative total was 702 species. Thereafter, fewer new species were added. Similarly, the discovery of bryophyte species at Rocky Fork dropped after 24 collecting trips (Smucker 2016). Both the vascular plant and bryophyte curves suggest that collection productivity is highest for the first 20–25 collection days (if these span the range of habitats and localities as well as the growing season) and collections at Rocky Fork for both plant groups have been fairly complete.

Largest Families

The four families represented by the most species at Rocky Fork (in descending order: Asteraceae, Poaceae, Cyperaceae, Fabaceae) were similar to the families most highly represented in other floras from the region (Table 1; Huskins & Shaw 2010; Klahs 2014). The Asteraceae had the highest number of species at Rocky Fork but neither the highest number of rare or exotic species (Table 1). Families with the highest proportions of species on both the Tennessee Rare Plant List and the Cherokee National Forest Species Viability List were the Cyperaceae and Orchidaceae, two families for which there were no exotic species in Rocky Fork (Table 1). These relatively high numbers of rare species may reflect the disproportionate representation of these families on rare plant lists (Table 1). Moreover, the high rare:exotic ratio in those two families is also a consequence of the dearth of exotics in those families and especially the rarity with which members of those families invade and thrive in disturbed sites. Among the large families, the highest numbers and proportions of exotics at Rocky Fork were in the Poaceae and Fabaceae while the numbers of rare listed species in those families were two and one, respectively (Table 1). Based on a literature review, Daehler (1998) concluded those two plant families were overrepresented as weedy invaders of natural areas (as opposed to agricultural areas) and Pyšek (1998) showed they had the highest proportions of aggressively invasive species.

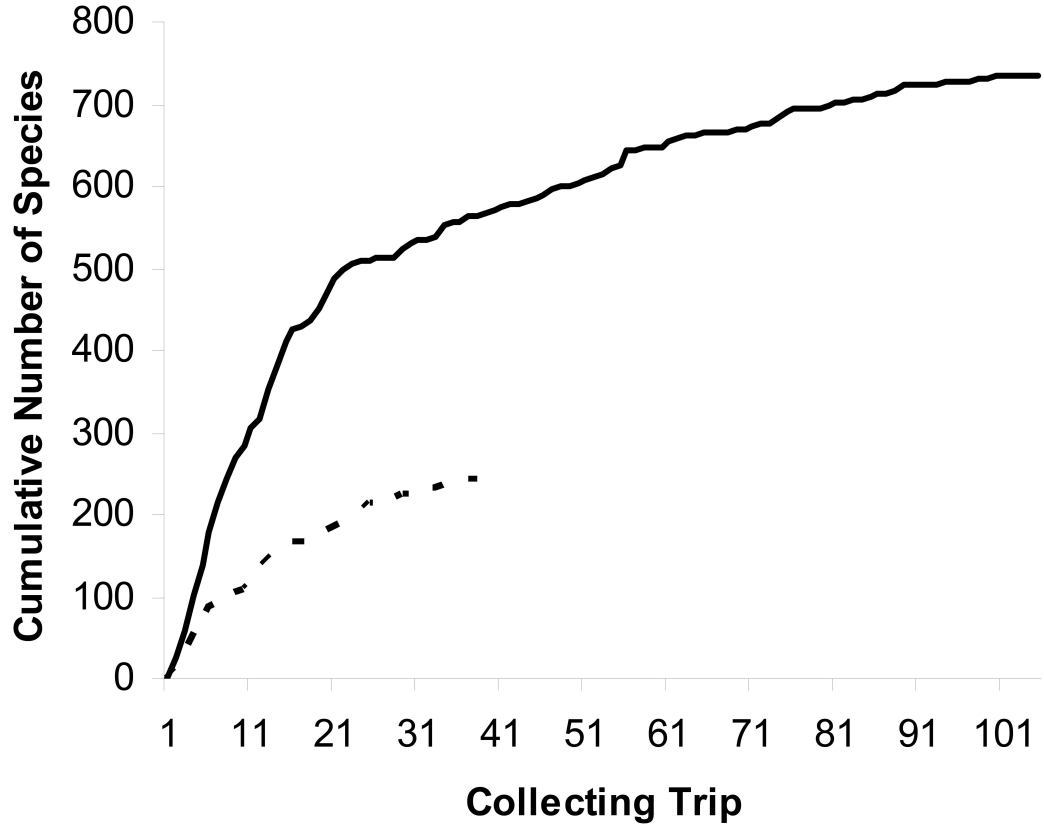

Fig. 2. Species accumulation curve for vascular plants (solid line) and bryophytes (dashed line). For vascular plants, collecting trips 1–21 correspond to 2009, 22–49 correspond to 2010, 50–80 correspond to 2011, with fewer trips in subsequent years.

Rare Species

Nineteen Rocky Fork species are listed on the Tennessee Rare Plant List of which four are categorized Endangered, six are Threatened, and nine are Species of Special Concern (Table 2; Tennessee Department of Environment and Conservation 2014). Thirty-four species are considered Species of Viability Concern on the Cherokee National Forest with nine ranked F1 ("Extremely rare on the forest unit, generally 1–5 occurrences"), 11 ranked F2 ("Very rare on the forest unit, generally 6–20 occurrences"), and 14 ranked F3 ("Rare and uncommon on the forest unit, from 21–100 occurrences") (Table 2; USDA Forest Service 2004). With much overlap between the two lists, a total of 38 species in the Rocky Fork Tract are tracked by state and federal agencies.

Of the state Endangered species, *Veratrum latifolium* was an isolated occurrence with few individuals and *Capnoides sempervirens* occurred as small populations on three widely dispersed rock outcrop sites. Both species are ranked F1 by the Cherokee National Forest. At the time of its discovery at one location in the Lower Higgins Creek drainage in 2009, *Spiranthes ochroleuca* was considered extirpated from the state. A specimen was sent to New York State Botanist, Charles Sheviak, who confirmed the identification based on floral morphology and the absence of polyembrony in ovules. *Spiranthes ochroleuca* has since been found at Roan Mountain, Holston Mountain, and Unaka Mountain regionally, and has been reported from a more distant site by others. Other noteworthy species from the Lower Higgins Creek drainage site include *Lathyrus venosus* and *Malaxis unifolia*, the latter also noted at other Tennessee *S. ochroleuca* sites by us and in New York by C. Sheviak

Table 1. Numbers of species in the four largest families and the Orchidaceae in Rocky Fork and the number in each family that are exotic or represented on the Tennessee Rare Plant List (TN) or the Cherokee National Forest Species Viability List (CNF).

		Family				
		Asteraceae	Poaceae	Cyperaceae	Fabaceae	Orchidaceae
Rocky Fork	Total species	111	81	44	37	18
TN Listed species (% of RF)		1 (0.9)	1 (1.2)	2 (4.5)	0 (0)	3 (16.7)
CNF Listed species (% of RF)		5 (4.5)	1 (1.2)	5 (11.4)	1 (2.7)	4 (22.2)
Exotic species (% of RF)		17 (15.3)	26 (31.7)	0 (0)	17 (45.9)	0 (0)
TN Rare List	Total species	53	29	54	11	20
(RF listed species/TN listed, as %)		(1.9)	(3.4)	(3.7)	(0)	(15.0)
CNF List	Total species	26	5	19	4	17
(RF listed species/CNF listed, as %)		(19.2)	(20.0)	(26.3)	(25.0)	(23.5)

(pers. comm.). Of the three additional F1 species, a few individuals of *Botrychium matricariifolium* occurred at a single site, *Goodyera repens* had small populations dispersed near creeks, and *Brachyelytrum aristosum*, a species reported from only one other Tennessee county, was found at higher elevations in several locations.

Some of the remaining rare species occur in single locations with few individuals and can be considered rare at Rocky Fork (*Carex folliculata*, *Streptopus lanceolatus*). In the 1990s, *Adlumia fungosa* was abundant on the slope across from the mouth of Flint Creek but it has since disappeared from that site and now occurs as a few plants just outside the tract boundary along Rocky Fork Road.

Species that are state listed because they are threatened by exploitation include *Allium tricoccum* and *Panax quinquefolius*, and state listed species threatened by pests and disease include *Castanea dentata*, *Juglans cinerea*, and *Tsuga caroliniana*, the latter represented by few small individuals. *Lilium superbum*, but not *L.michauxii*, is severely impacted by lily leaf spot disease caused by the fungal phytopathogen, *Pseudocercosporella inconspicua* (G. Winter) U. Braun (Ingram et al. 2017). *Poa palustris*, a state and national forest listed species, was represented by a specimen at TENN that was annotated by H. DeSelm. We have concern about the identity of the specimen but do not disagree with the determination and include the species in the flora. Four additional state and national forest listed species (*Coreopsis latifolia* Michx.; *Caulophyllum giganteum* [Farw.] Loconte & W.H. Blackwell; *Dryopteris carthusiana* (Vill.) H.P. Fuchs; *Fallopia cilinodis* (Michx.) Holub were reported to the state natural heritage program (R. McCoy, pers. comm.) but no specimens could be located. Because each could be mistaken for a more common closely related species, these unverified records were not included in the flora.

Disjunct Species

One exotic (*Veronica polita*) species was a regional disjunction while 14 native and three exotic species were local disjunctions of which several native species (*Dichanthelium acuminatum* var. *lindheimeri*, *Gamochaeta purpurea*, *Solidago juncea*, *Sphenopholis obtusata*, *Symphyotrichum dumosum*, *Tilia americana* var. *americana*, *Vulpia octoflora* var. *octoflora*, *Xanthium strumarium*) are not uncommon. Rather, the absence of records is indicative of a region or species under-represented in prior collections. The more noteworthy disjunctions include; *Dichanthelium meridionale*, found in a sandy area at 1500 m, and *Dichanthelium sphaerocarpon*, found on the dry quartzite outcrop of Whitehouse Cliffs and on the south slope of Playyard Ridge, *Lonicera sempervirens* which occurs on partly shaded outcrops in several localities, *Stenanthium gramineum*, also at multiple localities but with small numbers of individuals at each, and *Viola sagitatta* var. *ovata* on dry sites. Lack of adequate collections rather than rarity in the region is the likely explanation for the paucity of local collections of the Blue Ridge endemics *Actaea podocarpa*, *Eurybia chlorolepis*, and *Listera smallii* and also for the more widespread *Cinna arundinacea*, *Gratiola neglecta*, *Luzula bulbosa*, *L. echinata*, *Muhlenbergia sylvatica*, and *Phacelia purshii*. *Carex pedunculata* and *C. scabrata* are more northern species but both are common in the mountains of upper

TABLE 2. Species listed on the Tennessee Rare Plant List (TN) and the Cherokee National Forest Species Viability List (CNF) with Global Ranks (G Rank). Tennessee status: E = Endangered, T = Threatened, S = Special Concern, CE = Commercially Exploited; State ranks: S1 = Extremely Rare (1–5 occurrences), S2 = Very Rare (6–20 occurrences), S3 = Rare and Uncommon (21–100 occurrences); Cherokee National Forest Categories: F1, F2, F3 have similar interpretations as the corresponding state rank, S = Regional forester's Sensitive Species List.

Genus	Species	TN Status, Rank	CNF Status, Rank	G Rank
Adlumia	*fungosa*	T, S2	F2	G4
Allium	*tricoccum*	S-CE, S1S2		G5
Botrychium	*matricariifolium*	S, S1	F1	G5
Brachyeletrum	*aristosum*	S, S2	F1	G4G5
Capnoides	*sempervirens*	E, S1S2	F1	G5
Cardamine	*flagellifera*	T, S2	F2	G3
Carex	*aestivalis*		F2	G4
Carex	*appalachica*		F1	G4
Carex	*folliculata*	T, S1		G4G5
Carex	*leptonervia*		F2	G5
Carex	*roanensis*	S, S2	F2	G2G3
Carex	*scabrata*		F1	G5
Castanea	*dentata*	S, S2S3	F3	G4
Chelone	*lyonii*		F3	G4
Chrysosplenium	*americanum*		F3	G5
Cirsium	*altissimum*		F3	G5
Diphylleia	*cymosa*		F3	G4
Eutrochium	*steelei*		F2	G4
Gentiana	*austromontana*		F3	G3
Goodyera	*repens*	S, S1	F1	G5
Helianthus	*glaucophyllus*	T, S1	F2	G3G4
Hieracium	*scabrum*		F1	G5
Juglans	*cinerea*	T, S3	F2	G4
Lathyrus	*venosus*		F2	G5
Liparis	*liliifolia*		F3	G5
Listera	*smallii*		F3	G4
Nabalus	*roanensis*		S, F3	G3
Panax	*quinquefolius*	S-CE, S3S4		G3G4
Platanthera	*psycodes*	S, S2	F2	G5
Poa	*palustris*	E, S1	F1	G5
Sanicula	*trifoliata*		F3	G4
Spiranthes	*ochroleuca*	E, S1		G4
Streptopus	*lanceolatus*	S, S2	F2	G5
Trillium	*undulatum*		F3	G5
Vaccinium	*erythrocarpum*		F3	G5
Veratrum	*latifolium*	E, S1S2	F1	G5
Veratrum	*viride*		F3	G5
Xerophyllum	*asphodeloides*	T, S3	F3	G4

east Tennessee (the former more common in the Ridge and Valley/Cumberland Plateau and the latter in the Blue Ridge physiographic province) and locally under-collected, while *Agrostis scabra* has western affinities and may be near the range margin.

Exotic Species

Except for roadsides, open fields, and former logging staging areas, the interior of the tract is virtually lacking in sites degraded by invasive exotics. Despite a history of logging throughout the tract, species dependent on high sunlight (i.e., early successional species) are largely native. When these areas have significant canopy openings and degraded soils, they are often initially dominated by *Phytolacca americana*, *Erechtites hieraciifolius*, and *Houstonia purpurea* followed by species of *Rubus*, *Solidago*, and *Symphyotrichum*. The majority of exotics and the highest densities of exotics occur in small acreages of land adjoining paved public roads and in interior fields that may have been maintained as wildlife openings.

A total of 113 exotic species comprised 15.3% of the flora of the tract. Families with relatively high proportions (≥50%) of exotics were the Celastraceae (3 exotics/4 species = 75%), Caprifoliaceae (3/5 = 60%), Plantaginaceae (6/10 = 60%, all six were *Veronica* spp.), and Brassicaceae (5/10 = 50%). Based on ranking of the Tennessee Exotic Pest Plant Council (2009; TN-EPPC) 12 of the exotics in Rocky Fork are considered Severe Threats, 13 are Significant Threats, 8 are Lesser Threats, and 11 are Alert species (http://www.tneppc.org). Twelve exotics were exclusively associated with former home sites and two (*Hedera helix*, *Hesperis matrionalis*) are ranked as Lesser Threat and Alert species, respectively by TN-EPPC. None of these are likely to spread well beyond homesites. Ten additional exotics were mostly associated with former logging staging areas. As these occurrences are localized and some pose a significant threat to spread, local eradication is feasible and recommended for *Kummerowia striata*, *Lespedeza bicolor*, *Lolium perenne*, *Lotus corniculatus*, *Medicago lupulina*, *Melilotus albus*, *M. officinalis*, *Perilla frutescens*, *Rosa multiflora*, and *Securigera varia*.

Some exotic species are already ubiquitous in the interior and most often associated with roads. These include *Microstegium vimineum*, a species shown to be associated with roads (Manee et al. 2015), *Persicaria longiseta*, *Poa annua*, *P. trivialis*, *Prunella vulgaris*, and *Taraxacum officinale*. Of utmost concern are the exotics most likely to disperse to and thrive in the interior. In the past 20 years, *Miscanthus sinensis* has become invasive in upper east Tennessee. In the Rocky Fork Tract, *Miscanthus sinensis* occurs as sporadic clumps along interior dirt roads and these can be readily seen and eradicated. Another robust grass, *Arrhenatherum elatius*, appears to be increasing in the region and occurs along Rocky Fork Road. *Elaeagnus umbellata* is local but sometimes occurs in greater numbers and can be more difficult to eradicate. Perhaps the most severe plant threat to the forest interior is from *Celastrus orbiculatus,* which is established in a wildlife opening near Bearwallow Gap on the northeast margin of the tract. Four locally distributed species have the potential to severely degrade streamside and lowland habitats. *Alliaria petiolata* was present as a population of approximately 30 plants near the base of an eroded log road up Flint Mountain (those plants were eradicated in 2013 but recolonization by dormant seeds is possible). Three species are exotics that are not currently in the interior of the tract. *Reynoutria japonica* and *R. sachalinensis* are abundant along the lower reaches of Lower Higgins Creek, Big Creek, Edwards Branch and Rocky Fork Creek (outside the tract) while *Lythum salicaria* is sporadic along nearby Rt. 352 and I-26.

DISCUSSION

Species Richness

The Rocky Fork Tract has high but not exceptional species diversity as evidenced by a comparison to floras from a sample of other areas in eastern Tennessee (Fig. 3). On a species-area plot, the point for the Rocky Fork Tract falls above the species-area regression line indicating that species richness is higher than expected based on comparisons to other regional areas. Of the three Tennessee park floras in close proximity to Rocky Fork (Bays Mountain Park, Sullivan Co.; Buffalo Mountain Park, Washington Co.; and Warriors Path State Park, Sullivan Co.), all are much smaller in area (<700 ha) and all have fewer species. Compared to the four sites with comparable areas (2800–5001 ha), only the richness of the flora of the Tennessee River Gorge, with 700 species, approaches that of Rocky Fork. Compared to the much larger Great Smoky Mountains National Park (210,876 ha) with 1714 species (Discover Life in America), Rocky Fork has 1.8% of the area, 43.5% as many vascular plant species, and 51.4% as many bryophytes.

The proportion of exotic species from twelve sites in the Cumberland Plateau in Kentucky and Tennessee, ranged from <1% for the smallest area (52 ha) to 16% for the largest area (10,300 ha) (Huskins & Shaw 2010). While this places the Rocky Fork Tract at the upper end of the range for exotics, the vast majority of the interior acreage at Rocky Fork is free of exotics except for areas in proximity to dirt/gravel roads and open fields. Moreover, only small areas near paved roads are dominated by exotics. Whereas rare species comprised 2–3% of the Cumberland Plateau floras, at Rocky Fork, state listed rare species comprised 2.6%, Cherokee National Forest listed species 4.4%, and the combined total of listed species comprised 5.0% of the flora. Thus, the number and proportion of state and national forest listed species at Rocky Fork is relatively high.

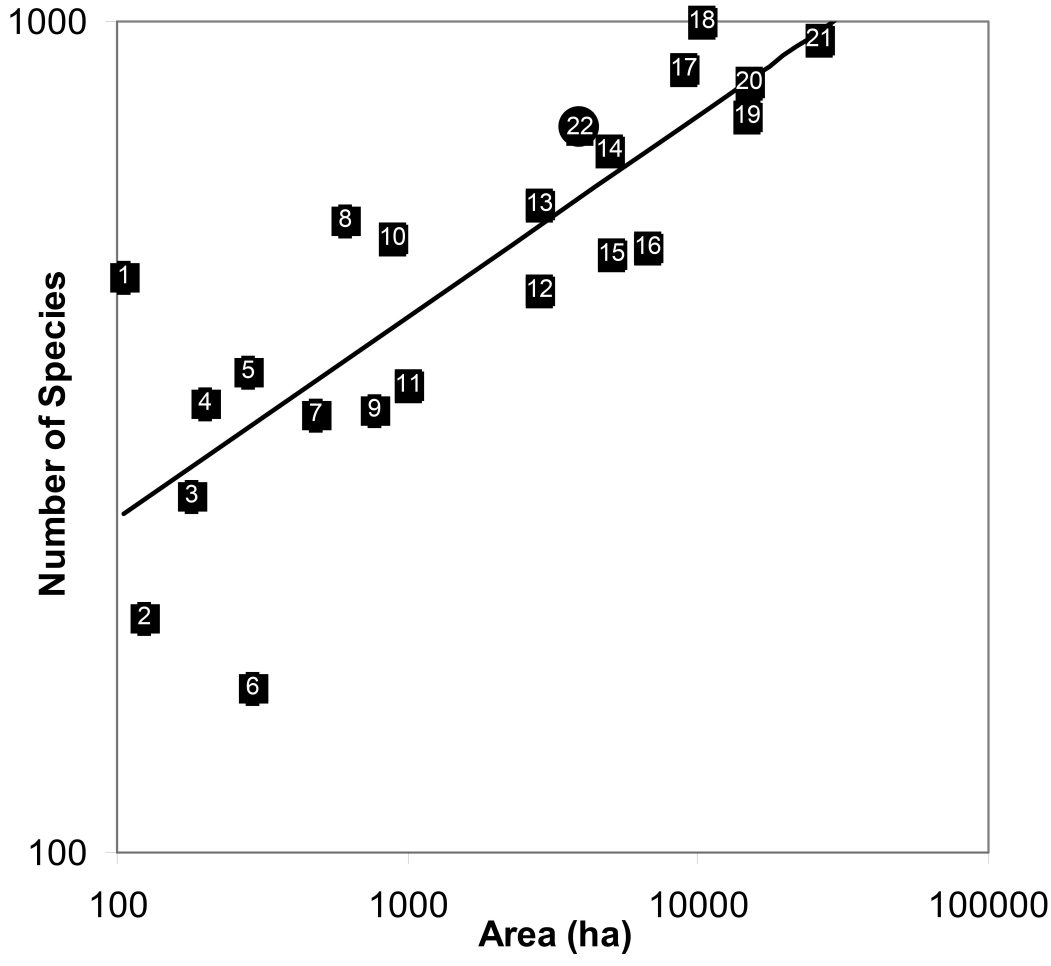

Fig. 3. Species-area plot showing numbers of species reported in floras of areas in eastern Tennessee, both plotted on $\log_{10}$ scales (adapted from Klahs 2014). The symbol for Rocky Fork is round (point 22) while all others are square. Key to areas: 1 = Red Clay State Historical Area; 2 = Turkeypen Gorge; 3 = Laurel Run Gorge; 4 = Sinking Creek Area; 5 = Forge Hill; 6 = Buffalo Mountain; 7 = Bays Mountain; 8 = Warriors Path State Park; 9 = Panther Creek State Park; 10 = Steele Creek Park; 11 = Gee Creek Wilderness; 12 = Big Frog Mountain; 13 = Chickamauga Creek Gorge; 14 = Tennessee River Gorge; 15 = Upper Clinch River; 16 = Citico Creek Wilderness Study Area; 17 = Fall Creek Falls State Park; 18 = Prentice Cooper State Forest; 19 = Sequatchie Valley; 20 = Oak Ridge; 21 = Chilhowee Mountain; 22 = Rocky Fork Tract.

Refuges and Isolated Occurrences

If a refuge can be considered an area where members of a species occur in relatively large numbers and where they are protected from destruction, or as an area that supports a viable metapopulation, then Rocky Fork can be considered a refuge for several rare species that are not regionally common outside the tract. *Cardamine flagellifera* is abundant in some sections of the main stem of Rocky Fork Creek but it also can be found from near the mouth of Rocky Fork Creek up to where headwater tributaries enter, but not in smaller drainages such as those of Flint Creek or Lower Higgins Creek. Large populations of *Thalictrum coriaceum*, a species formerly state listed, occur near the tract boundary in a low lying area along the lower reaches of Higgins Creek and its small tributaries. The distribution of *Helianthus glaucophyllus* at Rocky Fork constitutes an example of a viable metapopulation as it is widespread throughout the tract where it can be found at many locations, never in large

numbers, and many occurrences are near old log roads or openings. Similarly, *Platanthera psycodes* is found at several localities, all streamside but none with more than 20 individuals. The most striking occurrence of *Xerophyllum asphodeloides* is an extensive population localized to a unique bald near the Ball Ground where it forms an understory below *Rhododendron catawbiense*. A smaller population occurs on the Rich Mountain ridge 5 km east of the Ball Ground. At the Ball Ground, flowering was abundant prior to 2010 but has since declined as shade from the *Rhododendron* and other ericaceous shrubs appear to have increased. The bald population is the northern extent of a population that extends down Middle Spring Ridge into the Sampson Mountain Wilderness.

Isolated species occurrences of more than a few individuals but less than 50 include *Capnoides sempervirens*, restricted to three sunny outcrops, and *Stenanthium gramineum* and *Amorpha glabra*, both of which occur in small numbers from at least three sites each. Both *A. glabra* and *X. asphodeloides* tend to occupy dry, mid-elevation (800–1500 m) sites and in Tennessee, are more common in the mountains to the south. This is the northeastern-most extent of the *A. glabra* range. Occurrences of noteworthy species as single individuals or a single small population include *Botrychium matricariifolium*, *Isöetes valida*, *Spiranthes ochroleuca*, and *Veratrum latifolium*. Obviously, these species are most subject to local extinction.

Limits to Diversity

Species richness in the tract is limited by several physiographic and anthropogenic factors. With an upper elevation of 1475 m, there is no spruce-fir forest zone and few of the species associated with that and other high elevation communities. As the entire tract lies within first and second order drainages with moderate to steep slopes, riparian areas are narrow (there are no canebrakes), wetlands are small in size (<0.5 ha) and few in number, and tend to be in partial or full shade. There are no natural lakes, but two man-made impoundments are present; a small pond near the mouth of Flint Creek and a 7 ha lake at the head of Birchfield Branch in the Higgins Creek drainage. Further, while the tract lies on the border of the Ridge and Valley physiographic province, and limestone outcroppings regularly occur in that physiographic province, no such outcroppings occur within the study area. However, the Ashe Loam soil in the Lower Higgins Creek drainage does tend to a more neutral pH. While there are some meadow openings, notably at the Ball Ground and Wilson Knob, these are not naturally occurring and support a higher proportion of exotics and pasture grasses compared to natural balds. Nevertheless, the bulk of the exotics and disturbance-dependent diversity is associated with the lowest elevations, particularly those that adjoin the paved roads and neighboring pastures.

Noteworthy Sub-specific Variants and Taxonomic Uncertainties

Bromus pubescens is common in mesic upland forests and appears in the typical form with pubescence near leaf collars, and on glumes and lemmas. However, at several Rocky Fork sites this species is represented by an entirely glabrous form. Forms with glabrous glumes and lemmas are apparently rare (Pavlick & Anderton 2007). The glabrous form shows no apparent correlation with habitat or elevation. *Gentiana austromontana* is common in mesic–dry forests and edges while *G. decora* occurs in similar habitats but is less common. Dr. James Pringle (pers. comm.) examined the 42 gentian specimens from the Rocky Fork collection and hypothesized these two species form a hybrid complex in the Rocky Fork Tract. In Tennessee, *Antennaria howellii* Greene ssp. *neodioica* (Greene) Bayer, an apomictic polyploid, is near the southern limit of its range (Bayer & Stebbins 1982, Bayer 1989). Three species with noteworthy color variants were found: *Rhododendron minus* occurs in several locations as the white flowered form; a white-flowered morph of *Polygala paucifolia* is present as several individuals at upper Ft. Davie Creek; and a population of yellow *Hypopitys monotropa* occurs near Big Butt. The taxonomic significance of color and phenology variation in *Hypopitys* is an area of active investigation (Broe 2014; Klooster & Cully 2010). In contrast, discontinuous variation characterizes the deciduous *Ilex* taxa at Rocky Fork. *Ilex montana* is common in the middle to higher elevations (>1000 m) where leaf morphology is uniformly glabrous with shiny adaxial surfaces. On dry lower elevation (<1000 m) oak-hickory dominated slopes, especially on less acid soils near Lower Higgins Creek, Edwards Branch, and the west slope adjoining lower Rocky Fork Creek, an *Ilex* occurs whose leaf undersides and twigs are pubescent and the adaxial surface

is not shiny. The *Guide to the Vascular Plants of Tennessee* treats the pubescent, lower elevation entity as *I. ambigua* (Michx.) var. *ambigua* and the glabrous form as *I. ambigua* (Michx.) Torr. var. *montana* (Torr. & A. Gray) H.E. Ahles (Chester et al. 2015). A study of morphological variation in the southeastern U.S. deciduous hollies showed an apparent range of variation in leaf pubescence (Krakow 1989). However, leaf pubescence was measured as a three state variable (glabrous; vein pubescence; abaxial suface pubescence) rather than a continuous character. Moreover, of the two populations from the Southern Appalachian mountains included in the study (Graham Co., NC; Sevier Co., TN), one was uniformly pubescent on the adaxial leaf surface and the other nearly so (Fig. 2 in Krakow 1989). This group merits additional study. The pubescent form is distinct from *I. montana* in habitat, is restricted to lower elevations and less acidic soils, and no intermediate forms have been observed. In light of this information, it seems more appropriate to treat these as the strongly pubescent mountain species, *I. beadlei* Ashe, as envisioned by Ashe (1897) and Kearney (1897), rather than lump these with either *I. montana* or the non-mountain forms of *I. ambigua* (Weakley et al. 2012).

Future Directions and Management Recommendations

With the species accumulation curve indicating the collection is fairly complete, the discovery of significant numbers of additional species depends upon collections in unvisited areas, and of potential greater importance, on the uniqueness of these areas. Based on these criteria, the most promising locations for future work would be on Flint Ridge with its east-facing steep slopes and numerous drainages, the steep south-facing slopes of Higgins Ridge, and the cliffs along Rocky Fork Creek across from Whitehouse Cliffs. As there were fewer trips to the higher elevation sites along the southwest border of the tract, including the Appalachian Trail reroute, this area may also be targeted for additional study. Of the other high elevation sites within the tract, Wilson Knob is floristically unremarkable as it has been maintained as a wildlife opening and while Frozen Knob shows evidence of logging, it supports a population of *Stenanthium gramineum*.

The bulk of the tract, comprised largely of mid-successional forest, requires little management as it is largely free of invasive exotics and the widespread moist, mixed deciduous forest has few, if any, fire-adapted species. Rather, management should be directed at preventing degradation from human activity. For example, if horses are permitted, feed should be weed-free and trails located away from riparian zones. Many sun-loving native species are found along the extensive unpaved road network and to preserve this habitat and allow for seed production from species such as *Helianthus glaucophyllus*, these roadside areas should not be manicured —any cutting should take place at intervals greater than one year and the work should be conducted outside the growing season. Roadside populations of *Amorpha glabra* have already suffered loss of individuals and reductions in reproduction from severe cutting of roadside vegetation.

Few areas and relatively small acreages of the tract appear to be comprised of species associated with fire. Since controlled burns are routinely used on national forest lands in the southern Appalachians there is a risk that burning will be used on sites like the *Rhododendron catawbiense-Xerophyllum* bald without first considering other management options. *Xerophyllum asphodeloides* is thought to be fire-dependent (Bourg et al. 2015) and flowering at the Rocky Fork bald has decreased from 2009 to 2015 so fire might seem to be an appropriate management strategy for this species. However, first, a management goal should be set, as for now, the habitat is probably saturated with individuals. Therefore, seed production is unlikely to increase population size. In Virginia, fire increased flowering and seed production in *X. asphodeloides* but gave no increase in seedling establishment (Bourg et al. 2015). Hence, a more appropriate goal would be to prevent decline in vigor and attrition caused by excessive shade or senescence. To achieve this goal, opening the canopy would be prescribed and this can be accomplished without fire. The most prudent approach would utilize an on-site experimental approach with small replicated plots including two treatments (burn vs. manual thinning) and controls. There is no rational conservation objective to be met with fire elsewhere in the tract, as fire in moist deciduous forests of the region degrades the diversity of herbaceous species (Zimmerman 2006).

Soil pockets on rock outcrops should not be disturbed, as these are habitat for the state endangered *Capnoides sempervirens*. Moreover, runoff from larger outcrops results in small moisture-saturated pockets. For

example, of two known occurrences of living *Juglans cinerea*, one is at the base of a large outcrop on the south side of Snakeden Ridge. A larger individual, located near the main gate on Rocky Fork Creek, succumbed to canker disease in 2011.

Wetlands are small and few in number so disturbance and road runoff should be minimized. The backwaters of the lake are the only known site for *Isöetes valida* and it also supports a stand of *Scirpus cyperinus* and associated wetland species. Lake levels that preserve this wetland should be maintained. In this largely forested, mountainous tract, small wet areas can support plants not found elsewhere. For example, small (<0.01 ha) naturally saturated riparian zones along small branches, some close to roads, are sites for *Platanthera psycodes* and *Veratrum viride*. Unexpected occurrences of a suite of wetland species such as *Alisma subcordatum*, *Bidens polylepis*, *Echinochloa muricata* var. *muricata*, *Gratiola neglecta*, *Iva annua*, *Oryza sativa*, and *Scirpus atrovirens* occur on a dirt road, in permanently ponded areas near a ridge just east of Bearwallow Gap. While the presence of *O. sativa* suggests human, fowl, or equine-mediated transport, the native species associated with the ponded areas are more indicative of natural occurrences.

APPENDIX

Species in the Rocky Fork Tract listed alphabetically by family within vascular plant groups. Abbreviations: Listed species: **TN** = Tennessee Rare Plant List, **CNF** = Cherokee National Forest Species Viability List; County records: **G** = Greene, **U** = Unicoi; **Ex** = exotic species; Disjunctions: **L** = local, **R** = regional. Collection number of a representative specimen follows name and abbreviations. **Sight** = Sight record. All collections were by Levy and Walker or Levy.

PTERIDOPHYTES

Aspleniaceae
Asplenium montanum Willd. RF1389
Asplenium platyneuron (L.) B.S.P. RF1138
Asplenium rhizophyllum L. RF2111
Asplenium trichomanes L. RF4089

Dennstaedtiaceae
Dennstaedtia punctilobula (Michx.) T. Moore RF1490
Pteridium aquilinum (L.) Kuhn ssp. *latiusculum* (Desv.) Hulten RF1240

Dryopteridaceae
Dryopteris intermedia (Muhl. ex Willd.) A. Gray RF1512
Dryopteris marginalis (L.) A. Gray RF3356

Equisetaceae
Equisetum arvense L. RF3337

Isöetaceae
Isöetes valida (Engelm.) Clute U RF2729

Lycopodiaceae
Dendrolycopodium hickeyi (W.H. Wagner, Beitel, & R.C. Moran) A. Haines RF3770
Dendrolycopodium obscurum (L.) A. Haines RF1256
Diphasiastrum digitatum (Dill. ex A. Braun) Holub RF2723
Huperzia lucidula (Michx.) Trev. RF1604
Lycopodium clavatum L. RF1115

Ophioglossaceae
Botrychium matricariifolium (A. Braun ex Dowell) A. Braun & W.D.J. Koch TN, CNF, G RF3480
Botrypus virginianus (L.) Holub. RF1139
Sceptridium biternatum (Sav.) Lyon RF2786
Sceptridium dissectum Spreng. (Lyon) RF1796

Osmundaceae
Osmunda claytoniana L. var. *claytoniana* RF2391
Osmunda spectabilis Willd. RF2498
Osmundastrum cinnamomeum (L.) C. Presl RF1133

Polypodiaceae
Polypodium virginianum L. RF1035

Pteridiaceae
Adiantum pedatum L. RF1191

Selaginellaceae
Lycopodioides apodum (L.) Kunze RF2257

Thelypteridaceae
Parathelypteris noveboracensis (L.) Ching RF1925
Phegopteris hexagonoptera (Michx.) Fee RF1540

Woodsiaceae
Athyrium asplenioides (Michx.) A.A. Eaton RF2203
Cystopteris protrusa (Weath.) Blasdell RF1153
Deparia acrostichoides (Sw.) M. Kato RF3355

GYMNOSPERMS

Cupressaceae
Juniperus virginiana L. var. *virginiana* RF2881
Thuja occidentalis L. RF2039

Pinaceae
Pinus pungens Lamb. RF1113
Pinus rigida Mill. RF1965
Pinus strobus L. Sight
Pinus virginiana Mill. Sight
Tsuga canadensis (L.) Carr. Sight
Tsuga caroliniana Engelm. RF3649

MONOCOTS

Alismataceae
Alisma subcordatum Raf. U RF3211
Sagittaria latifolia Willd. U RF3577

Amaryllidaceae
Allium tricoccum Ait. TN RF0018
Allium vineale L. Ex RF2030
Narcissus pseudonarcissus L. U, Ex, R RF2043

Araceae
Arisaema triphyllum (L.) Schott ssp. *triphyllum* RF2360

Colchicaceae
Uvularia grandiflora J.E. Smith RF1597
Uvularia perfoliata L. RF1058
Uvularia puberula Michx. G, U RF3172
Uvularia sessilifolia L. RF1068

Commelinaceae
Commelina communis L. Ex RF1482
Tradescantia subaspera Ker-Gawl. RF2357

Cyperaceae
Carex aestivalis M.A. Curtis ex A. Gray CNF, U RF1938
Carex allegheniensis Mack. RF1876
Carex amphibola Steud. RF1152
Carex appalachica J.M. Webber & P. Ball CNF RF1724
Carex atlantica Bailey ssp. *atlantica* U RF4073
Carex blanda Dewey 16377
Carex bromoides Schkuhr ex Willd. ssp. *bromoides* U RF3050
Carex brunnescens (Pursh) Poir. var. *sphaerostachya* (Tuck.) Kük. U RF4071
Carex cephalophora Muhl. ex Willd. U RF2263
Carex communis Bailey var. *communis* U RF2129
Carex debilis Michx. RF4107
Carex digitalis Willd. var. *digitalis* RF2198
Carex flexuosa Muhl. ex Willd. RF1206
Carex folliculata L. TN, G 15318
Carex frankii Kunth. U RF1548
Carex gynandra Schwein. G RF1232
Carex intumescens Rudge var. *fernaldii* Bailey RF2287
Carex laevivaginata (Kuk.) Mack. U RF2235
Carex leptonervia (Fern.) Fern. CNF, G RF2223
Carex lupulina Muhl. G RF1831
Carex lurida Wahlenb. RF1140
Carex nigromarginata Schwein. U RF3094
Carex normalis Mack G RF1319
Carex pedunculata Muhl. ex Willd. U RF2201
Carex pensylvanica Lam. U RF2083
Carex plantaginea Lam. RF0008
Carex prasina Wahl. RF1135
Carex roanensis F.J. Herman TN, CNF RF2359
Carex rosea Schkuhr ex Willd. U RF1142
Carex scabrata Schwein. CNF, G, U RF1213
Carex scoparia Schkuhr ex Willd. RF2282
Carex swanii (Fern.) Mack. RF1184
Carex tonsa (Fern.) E.P. Bicknell 14142
Carex tribuloides Wahl. var. *tribuloides* U RF1439
Carex virescens Muhl. ex Willd. RF2173
Carex vulpinoidea Michx. G RF1149
Cyperus flavescens L. RF2887
Cyperus strigosus L. RF2699
Eleocharis obtusa (Willd.) Schult. RF1818
Kyllinga gracillima Miquel U RF2838
Kyllinga pumila Michx. U RF2883
Scirpus atrovirens Willd. U RF1253
Scirpus cyperinus (L.) Kunth. RF2545
Scirpus polyphyllus Vahl. RF1830

Dioscoreaceae
Dioscorea polystachya Turcz. Ex RF2701
Dioscorea villosa L. RF2206

Hypoxidaceae
Hypoxis hirsuta (L.) Coville RF1905

Iridaceae
Iris cristata Ait. RF1043
Iris verna L. var. *smalliana* Fern. ex M.E. Edward RF3775
Sisyrinchium angustifolium P. Miller RF1151

Juncaceae
Juncus acuminatus Michx. RF2542
Juncus anthelatus (Weig.) R.E. Brooks RF3534
Juncus coriaceus Mack. U RF3419
Juncus debilis A. Gray RF3876
Juncus effusus L. RF2503
Juncus marginatus Rost. RF2580
Juncus tenuis Willd. G RF1141
Luzula acuminata Raf. RF1698
Luzula bulbosa (Wood) Smyth & Smyth RF3288
Luzula echinata (Small) F.J. Herm. RF2101
Luzula multiflora (Ehrh.) Lejune var. *multiflora* U RF3286

Liliaceae
Clintonia umbellulata (Michx.) Morong RF1095
Erythronium umbilicatum Parks & Hardin ssp. *umbilicatum* RF3103
Lilium michauxii Poir. RF1257
Lilium superbum L. RF1470
Medeola virginiana L. RF1064
Prosartes lanuginosa (Michx.) D. Don. RF2352
Streptopus lancelolatus (Ait.) Reveal var. *lanceolatus* TN CNF RF2295

Melianthaceae
Stenanthium gramineum (Ker Gawl.) Morong G, U, L RF1693
Trillium erectum L. RF1017
Trillium erectum f. *album* (Michx.) Salisb. RF0012
Trillium undulatum Willd. CNF RF1081
Veratrum latifolium (Desr.) Zomlefer TN, CNF, G RF1584
Veratrum parviflorum Michx. RF3856
Veratrum viride Ait. CNF RF1178

Orchidaceae
Aplectrum hyemale (Muhl. ex Willd.) Torr. RF2271
Cleistesiopsis bifaria (Fern.) Pansarin & F. Barros RF3437
Corallorhiza odontorhiza (Willd.) Poir. RF2788
Cypripedium acaule Ait. RF1114
Cypripedium parviflorum Salisbury var. *parviflorum* CNF Sight
Cypripedium parviflorum Salisbury var. *pubescens* (Willd.) Knight U RF2054
Galearis spectabilis (L.) Raf. U RF3088
Goodyera pubescens (Willd.) R. Br. RF3956
Goodyera repens (L.) R. Br. TN, CNF RF1644
Liparis liliifolia (L.) Rich. ex Lindl. CNF RF2829
Listera smallii Wieg. CNF, U RF1248
Malaxis unifolia Michx. RF3509
Platanthera ciliaris (L.) Lindl. RF2638
Platanthera clavellata (Michx.) Luer G RF2323
Platanthera lacera (Michx.) G. Don RF3454
Platanthera psycodes (L.) Lindl. TN, CNF RF1302
Spiranthes ochroleuca (Rydb.) Rydb. TN RF3932
Tipularia discolor (Pursh) Nutt. RF2050

Poaceae
Agrostis capillaris L. U, Ex, L RF1354
Agrostis gigantea Roth U, Ex RF2601
Agrostis hyemalis (Walt.) B.S.P. U RF1522
Agrostis perennans (Walt.) Tuck. RF2540
Agrostis scabra Willd. G, U RF2646
Andropogon virginicus L. var. *virginicus* U RF2726
Anthoxanthum odoratum L. Ex RF1089
Arrhenatherum elatius (L.) J.&K. Presl var. *elatius* Ex RF3442
Arthraxon hispidus (Thunb.) Makino *hispidus* Ex RF2890
Brachyelytrum aristosum (Michx.) P. Beauv. ex Branner & Coville TN, CNF G, U RF2474
Brachyelytrum erectum (Schreb. ex Spreng.) P. Beauv. RF2361

Bromus commutatus Schrad. Ex RF1198
Bromus inermis Leyss. U, Ex RF2910
Bromus pubescens Muhl. ex Willd. RF3332
Cinna arundinacea L. U RF1806
Coleataenia anceps (Michx.) Soreng ssp. *anceps* U RF2897
Dactylis glomerata L. Ex RF1197
Danthonia compressa Austin ex Peck RF1960
Danthonia sericea Nutt. G, U RF1320
Danthonia spicata (L.) P. Beauv. ex Roem. & J.A. Schult. G RF1161
Dichanthelium acuminatum (Sw.) Gould & Clark var. *acuminatum* RF3368
Dichanthelium acuminatum (Sw.) Gould & Clark var. *fasiculatum* (Torr.) Freckman RF3609
Dichanthelium acuminatum (Sw.) Gould & Clark var. *lindheimeri* (Nash) Gould & Clark U, L RF2763
Dichanthelium boscii (Poir.) Gould & Clark U RF2317
Dichanthelium clandestinum (L.) Gould G RF1150
Dichanthelium commutatum (J.A. Schultes) Gould var. *ashei* Mohl. RF3292
Dichanthelium commutatum (J.A. Schultes) Gould var. *commutatum* RF3425
Dichanthelium depauperatum (Muhl.) Gould G RF1260
Dichanthelium dichotomum (L.) Gould var. *dichotomum* U RF2348
Dichanthelium dichotomum (L.) Gould var. *ramulosum* (Torr.) LeBlond 14468
Dichanthelium latifolium (L.) Harvill G RF1583
Dichanthelium laxiflorum (Lam.) Gould RF1350
Dichanthelium meridionale (Ashe) Freckman G, U, L RF2390
Dichanthelium polyanthes (J.A. Schultes) Mohl. RF1650
Dichanthelium sphaerocarpon (Ell.) Gould U, L RF3504
Digitaria ischaemum (Schreb.) Muhl. Ex RF1991
Echinochloa crusgalli (L.) P. Beauv. var. *crusgalli* Ex RF2918
Echinochloa muricata (P. Beauv.) Fern. var. *muricata* (P. Beauv.) Fern. U RF2760
Eleusine indica (L.) Gaertn. U, Ex RF2884
Elymus hystrix L. RF1378
Elymus riparius Wieg. U RF3886
Eragrostis pilosa (L.) P. Beauv. var. *pilosa* U RF2836
Festuca subverticillata (Pers.) Alexeev RF1147
Glyceria melicaria (Michx.) F.T. Hubb. RF2583
Glyceria striata (Lam.) A.S. Hitch. var. *striata* G RF2618
Holcus lanatus L. Ex RF1268
Leersia oryzoides (L.) Sw. U RF2976
Leersia virginica Willd. RF1590
Lolium perenne L. var. *aristatum* Willd. Ex RF3432
Lolium perenne L. var. *perenne* G, Ex RF1196
Microstegium vimineum (Trin.) A. Camus Ex RF1805
Miscanthus sinensis Anderss. G, U, Ex RF1913
Muhlenbergia frondosa (Poir.) Fern. U RF3973
Muhlenbergia schreberi J.F. Gmel. U RF1886
Muhlenbergia sobolifera (Muhl. ex Willd.) Trin. U RF2617
Muhlenbergia sylvatica (Torr.) Torr. ex Gray U RF1632
Muhlenbergia tenuiflora (Willd.) B.S.P. U RF1674
Oryza sativa L. U, Ex RF2857
Paspalum dilatatum Poir. U, Ex RF2895
Paspalum laeve Michx. U RF2801
Paspalum setaceum Michx. var. *ciliatifolium* (Michx.) Vasey U RF2894
Phalaris arundinacea L. RF3593
Phleum pratense L. G, Ex RF1309
Poa alsodes A. Gray G RF2061
Poa annua L. G, Ex RF1493
Poa compressa L. G, U, Ex RF2279
Poa cuspidata Nutt. RF0025
Poa palustris L. TN, CNF TENN-MAF046
Poa pratensis L. ssp. *pratensis* Ex RF2146
Poa trivialis L. ssp. *trivialis* Ex RF1263
Schedonorus arundinaceus (Schreb.) Dumort. U, Ex RF3073
Schedonorus pratensis (Huds.) P. Beauv. Ex RF3244
Schizachyrium scoparium (Michx.) Nash var. *scoparium* U RF2098
Setaria parviflora (Poir.) Kerguélen RF2917
Setaria pumila (Poir.) Roem. & Schult. ssp. *pumila* U, Ex RF2720
Sphenopholis nitida (Biehler) Scrib. U RF3435
Sphenopholis obtusata (Michx.) Scrib. U RF3434
Sphenopholis pensylvanica (L.) A.S. Hitch. RF3254
Sporobolus indicus (L.) R. Br. U RF2891
Tridens flavus (L.) A.S. Hitch. Ex RF2892
Vulpia octoflora (Walt.) Rybd. var. *octoflora* G, U, R RF2334

Ruscaceae
Convallaria pseudomajalis Bartram RF1062
Maianthemum canadense Desf. RF1088
Maianthemum racemosum (L.) Link RF1564
Polygonatum biflorum (Walt.) Ell. var. *biflorum* RF3136
Polygonatum biflorum (Walt.) Ell. var. *commutatum* (J.A. & J.H. Schultes) Morong RF3331
Polygonatum pubescens (Willd.) Pursh U RF1060

Smilaceae
Smilax glauca Walt. RF1321
Smilax herbacea L. RF1265
Smilax rotundifolia L. RF3291

Typhaceae
Typha latifolia L. U RF1977

Xanthorrhoeaceae
Hemerocallis fulva (L.) L. U, Ex RF2034

Xerophyllaceae
Xerophyllum asphodeloides (L.) Nutt. CNF, TN RF3769

DICOTS

Adoxaceae
Sambucus canadensis L. RF1274
Sambucus racemosa L. var. *pubens* (Michx.) Koehne RF1009
Viburnum acerifolium L. RF1237
Viburnum cassinoides L. RF1129
Viburnum lantanoides Michx. RF3543
Viburnum prunifolium L. U 14331

Anacardiaceae
Rhus typhina L. RF1462
Toxicodendron radicans (L.) Kuntze RF2110

Apiaceae
Angelica triquinata Michx. U RF1815
Crypototaenia canadensis (L.) DC. RF1215
Daucus carota L. Ex RF1382
Osmorhiza claytonii (Michx.) C.B. Clarke RF1038
Osmorhiza longistylis (Torr.) DC. U RF4050
Oxypolis rigidior (L.) Raf. U RF2559
Sanicula canadensis L. RF2320
Sanicula marilandica L. U RF3485
Sanicula odorata (Raf.) K.M. Pryer & L.M. Phillipe G RF2183
Sanicula trifoliata Bickn. CNF U RF1586
Taenidia integerrima (L.) Drude RF1781
Thaspium barbinode (Michx.) Nutt. RF1057
Thaspium trifoliatum (L.) A. Gray var. *flavum* S.F. Blake U RF1582
Zizia trifoliata (Michx.) Fern. RF1074

Apocynaceae
Asclepias exaltata L. RF3010

Asclepias quadrifolia Jacq. RF1186
Asclepias syriaca L. RF1507
Asclepias tuberosa L. var. *tuberosa* RF3490
Vinca minor L. U, Ex, R RF2037

Aquifoliaceae
Ilex beadlei Ashe RF2804
Ilex montana Torr. & A. Gray ex. A. Gray RF1966
Ilex opaca Ait. var. *opaca* RF1381
Ilex verticillata (L.) A. Gray G RF2324

Araliaceae
Aralia nudicaulis L. RF1315
Aralia racemosa L. RF1435
Aralia spinosa L. RF2309
Hedera helix L. U, Ex RF3483
Panax quinquefolius L. TN RF1368

Aristolochiaceae
Asarum canadense L. RF1020
Hexastylis heterophylla (Ashe) Small RF2382
Hexastylis shuttleworthii (Britten & Baker) Small var. *shuttleworthii* U RF3089
Isotrema macrophyllum (Lam.) C.F. Reed RF1486

Asteraceae
Achillea millefolium L. RF1306
Ageratina altissima (L.) King & H.E. Robins. var. *altissima* RF3738
*Ageratina altissim*a (L.) King & H.E. Robins. var. *roanensis* (Small) Clewell & Wooten RF3831
Ambrosia artemesiifolia L. U RF1545
Ambrosia trifida L. U RF1562
Antennaria howellii Greene ssp. *neodioica* (Greene) Bayer RF1034
Antennaria solitaria Rybd. RF2505
Arctium minus Bernh. Ex RF1577
Arnoglossum atriplicifolium (L.) H.E. Robin. RF1295
Arnoglossum reniforme (Hooker) H.E. Robin. U RF1723
Bidens bipinnata L. U, Ex RF2898
Bidens frondosa L. Ex RF1800
Bidens polylepis Blake U, Ex RF2757
Centaurea stoebe L. Ex RF3606
Chrysopsis mariana (L.) Ell. RF3934
Cichorium intybus L. U, Ex RF2431
Circium altissimum (L.) Hill CNF, U RF1710
Circium discolor (Muhl. ex Willd.) Spreng. U 15523
Cirsium vulgare (Savi) Tenore U, Ex RF2925
*Conyza canadensi*s (L.) Cronq. var. *canadensis* RF2521
Coreopsis major Walt. var. *major* RF1322
Coreopsis major Walt. var. *rigida* (Nutt.) F.E. Boynton RF3894
Crepis capillaris (L.) Wallr. Ex RF1363
Elephantopus carolinianus Raeusch. RF3703
Erechtites hieraciifolius (L.) Raf. ex DC. RF1802
Erigeron annuus (L.) Pers. RF1340
Erigeron philadelphicus L. var. *philadelphicus* RF3067
Erigeron pulchellus Michx. var. *pulchellus* RF2126
Eupatorium perfoliatum L. RF1808
Eupatorium pubescens Muhl. ex Willd. RF1900
Eupatorium serotinum Michx. G RF3870
Eupatorium sessilifolium L. var. *sessilifolium* RF2717
Eurybia chlorolepis (Burgess) Nesom G RF2539
Eurybia divaricata (L.) Nesom RF1559
Eurybia macrophylla (L.) Cass. RF1666
Eurybia surculosa (Michx.) Nesom RF3821
Eutrochium fistulosum (Barratt) E.E. Lamont G RF2532
Eutrochium purpureum (L.) E.E. Lamont var. *purpureum* RF2636
Eutrochium steelei (E.E. Lamont) E.E. Lamont CNF, G RF1720
Galinsoga quadriradiata Ruiz and Pav. Ex RF1609
Gamochaeta purpurea (L.) Cabrera G, U, L RF2338
Helianthus decapetalus L. RF1711
Helianthus divaricatus L. RF1636
Helianthus glaucophyllus D.M. Smith TN, CNF, G RF1616
Helianthus microcephalus Torr. & A. Gray U RF1489
Helianthus tuberosus L. RF2927
Heliopsis helianthoides (L.) Sw. var. *helianthoides* RF1713
Hieracium caespitosum Dumort. Ex RF1211
Hieracium gronovii L. U RF2724
Hieracium paniculatum L. RF1631
Hieracium pilosella Villars G, Ex RF2226
Hieracium scabrum Michx. CNF RF1970
Hieracium venosum L. RF2363
Hypochaeris radicata L. G, U, Ex RF1273
Iva annua L. G, U, Ex RF2755
Lactuca biennis (Moench.) Fern. U, L RF1797
Lactuca canadensis L. G, U RF1573
Lactuca floridana (L.) Gaert. RF2899
Lapsana communis L. Ex RF2245
Leucanthemum vulgare Lam. RF1173
Nabalus altissimus (L.) Hooker RF1639
Nabalus roanensis Chick. CNF RF1842
Nabalus trifoliatus Cass. G RF1524
Oclemena acuminata (Michx.) Greene RF3735
Packera anonyma (Wood) W.A. Weber & A. Löve U RF3251
Packera aurea (L.) A.&D. Löve RF3053
Pityopsis graminifolia (Michx.) Nutt. var. *latifolia* Fern. U RF3935
Polymnia canadensis L. RF2416
Pseudognaphthalium obtusifolium (L.) Hilliard and Burtt RF3900
Rudbeckia hirta L. var. *hirta* RF2658
Rudbeckia hirta L. var. *pulcherrima* Farwell U RF3526
Rudbeckia laciniata L. var. *laciniata* RF1880
Sericocarpus asteroides (L.) B.S.P. RF3630
Smallanthus uvedalia (L.) Mack. ex Small RF1635
Solidago altissima L. ssp. *altissima* RF2702
Solidago arguta Ait. var. *arguta* U RF2999
Solidago arguta Ait. var. *caroliniana* A. Gray G RF2992
Solidago bicolor L. RF1890
Solidago curtisii Torr. & A. Gray RF1626
Solidago erecta Pursh. G, U RF1640
Solidago flaccidifolia Small U RF1924
Solidago flexicaulis L. U RF1825
Solidago gigantea Ait. U RF2919
Solidago hispida Muhl. ex Willd. U RF2808
Solidago juncea Ait. G, U, L RF3626
Solidago nemoralis Ait. var. *nemoralis* RF3027
Solidago odora Ait. RF3019
Solidago patula Muhl. ex Willd. var. *patula* Muhl. U RF1485
Solidago puberula Nutt. var. *puberula* RF2535
Solidago roanensis Porter G RF2639
Solidago rugosa P. Miller var. *aspera* (Ait.) Cron. RF1959
Solidago speciosa Nutt. var. *speciosa* U RF3928
Solidago ulmifolia Muhl. ex Willd. RF3925
Sonchus asper (L.) Hill U, Ex RF1356
Symphyotrichum cordifolium (L.) Nesom RF2981
Symphyotrichum dumosum (L.) Nesom G, L RF3869
Symphyotrichum lanceolatum (Willd.) Nesom RF1891
Symphyotrichum lateriflorum (L.) A.&D. Löve RF3025
Symphyotrichum lowrieanum (Port.) Nesom RF1813
Symphyotrichum patens (Ait.) Nesom var. *patens* U RF1973
Symphyotrichum pilosum (Willd.) Nesom var. *pilosum* RF2921
Symphyotrichum puniceum (L.) A.& D. Löve RF1978
Symphyotrichum retroflexum (Lindl. ex DC.) Nesom RF1704

Symphyotrichum undulatum (L.) Nesom U RF1621
Taraxacum officinale G.H. Weber ex Wiggers Ex RF1012
Tussilago farfara L. Ex RF1407
Verbesina alternifolia (L.) Brit. ex Kearney RF2915
Verbesina occidentalis (L.) Walt. RF1610
Vernonia gigantea (Walt.) Trel. RF1633
Vernonia noveboracensis (L.) Michx. U RF1979
Xanthium strumarium L. U, L RF2602

Balsaminaceae
Impatiens capensis Meerb. RF1376
Impatiens pallida Nutt. U RF1406

Berberidaceae
Berberis thunbergii DC. U, Ex RF1364
Caulophyllum thalictroides (L.) Michx. RF0014
Diphylleia cymosa Michx. CNF RF1179
Podophyllum peltatum L. RF1094

Betulaceae
Betula alleghaniensis Britt. RF3401
Betula lenta L. Sight
Carpinus caroliniana Walt. RF1163
Corylus americana Walt. U RF2308
Ostrya virginiana (P. Miller) K. Koch RF1628

Bignoniaceae
Campsis radicans (L.) Seem. ex Bureau U RF2592

Boraginaceae
Buglossoides arvensis (L.) I.M. Johnson ssp. *arvensis* U, Ex RF3065
Hydrophyllum canadense L. RF1165
Phacelia bipinnatifida Michx. RF2255
Phacelia purshii Buckl. U RF1145

Brassicaceae
Alliaria petiolata (M. Bieb.) Cavara & Grande U, Ex RF2116
Barbarea vulgaris R. Br. Ex RF1027
Boechera canadensis (L.) Al-Shehbaz 16250
Boechera laevigata (Muhl. ex Willd.) Al-Shehbaz RF2311
Cardamine diphylla (Michx.) A. Wood RF0005
Cardamine flagellifera O.E. Schultz TN CNF, U RF2205
Cardamine hirsuta L. Ex RF2044
Cardamine pensylvanica Muhl. ex Willd. U RF1023
Hesperis matronalis L. Ex RF3304
Lepidium campestre (L.) R. Br. Ex RF3063
Rorippa palustris (L.) Besser ssp. *palustris* RF2947

Calycanthaceae
Calycanthus floridus L. RF2261

Campanulaceae
Campanula americana L. RF1520
Campanula divaricata Michx. RF1497
Lobelia cardinalis L. RF2605
Lobelia inflata L. RF3958
Lobelia puberula Michx. U RF3888
Lobelia siphilitica L. ssp. *siphilitica* RF1544
Triodanis perfoliata (L.) Nieuwland RF1402

Caprifoliaceae
Lonicera japonica Thunb. Ex RF1359
Lonicera sempervirens L. U, L RF1782
Symphoricarpos orbiculatus Moench U RF1026
Valerianella locusta (L.) Lat. U, Ex RF2252
Valerianella radiata (L.) Dufr. U RF3448

Caryophyllaceae
Arenaria serpyllifolia L. Ex RF3367
Cerastium fontanum (Baumg.) ssp. *vulgare* (Hart.) Greuter & Burdet U, Ex RF3166
Cerastium glomeratum Thuill. U, Ex RF3070
Cerastium nutans Raf. U RF3144
Dianthus armeria L. ssp. *armeria* Ex RF1346
Paronychia canadensis (L.) Wood RF1926
Silene antirrhina L. U RF1475
Silene latifolia Poir. Ex RF3892
Silene stellata (L.) Ait. RF1510
Silene virginica L. RF3323
Stellaria corei Shinners U RF2154
Stellaria media (L.) Villars U, Ex RF1013
Stellaria pubera Michx. RF0023

Celastraceae
Celastrus orbiculatus Thunb. U, Ex RF3170
Euonymus alatus (Thunb.) Siebold U, Ex RF3061
Euonymus americanus L. RF1167
Euonymus fortunei (Turcz.) Hand.-Mazz. U, Ex RF2032

Cistaceae
Lechea racemulosa Michx. RF3624

Clethraceae
Clethra acuminata Michx. RF1203

Convolvulaceae
Cuscuta gronovii Willd. ex J.A. Schultes U RF3915
Cuscuta rostrata Shuttlew. U RF1574
Ipomoea lacunosa L. U RF3710
Ipomoea pandurata (L.) G.F.W. Meyer U RF3361

Cornaceae
Cornus alternifolia L. RF1036-2
Cornus florida L. U RF2079

Crassulaceae
Sedum ternatum Michx. RF1047

Diapensiaceae
Galax urceolata (Poir.) Brummitt RF1104

Ebenaceae
Diospyros virginiana L. RF1299

Elaeagnaceae
Elaeagnus umbellata Thunb. Ex RF3169

Ericaceae
Chimaphila maculata (L.) Pursh G RF1224
Epigaea repens L. RF1007
Eubotrys recurvus (Buckl.) Brit. RF3398
Gaultheria procumbens L. RF1223
Gaylussacia baccata (Wangenh.) K. Koch U RF3150
Hypopitys monotropa Crantz U RF1645
Kalmia latifolia L. RF1171
Leucothoe fontanesiana (Steud.) Sleumer RF1245
Lyonia ligustrina (L.) DC. var. *ligustrina* G RF3415
Monotropa uniflora L. RF1399
Oxydendrum arboreum (L.) DC. Sight
Rhododendron calendulaceum (Michx.) Torr. RF1180
Rhododendron catawbiense Michx. RF1126
Rhododendron maximum L. RF1352
Rhododendron minus Michx. RF3501
Vaccinium altomontanum W.W. Ashe RF1529
Vaccinium corymbosum L. G RF1300
Vaccinium erythrocarpum Michx. CNF RF2305
Vaccinium pallidum Ait. RF1070
Vaccinium simulatum Small RF3201

Vaccinium stamineum L. RF3494

Euphorbiaceae
Acalypha rhomboidea Raf. RF1611
Acalypha virginica L. U RF3689
Euphorbia corollata L. RF1337
Euphorbia maculata L. U RF2893
Euphorbia nutans Lag. y Segura RF2916
Euphorbia pubentissima Michx. RF2912

Fabaceae
Albizia julibrissin Duraz. U, Ex RF2914
Amorpha glabra Desf. ex Poir. RF2162
Amphicarpaea bracteata (L.) Fern. RF3924
Apios americana Medik. RF2007
Astragalus canadensis L. var. *canadensis* RF1500
Baptisia tinctoria (L.) Ventenat RF3421
Chamaecrista nictitans (L.) Moench var. *nictitans* RF3711
Desmodium laevigatum (Nutt.) DC. RF1912
Desmodium paniculatum (L). DC. var. *paniculatum* RF3889
Desmodium perplexum Schub. RF1689
Hylodesmum glutinosum (Muhl. ex Willd.) H. Ohashi & R.R. Mill U 14330
Hylodesmum nudiflorum (L.) H. Ohashi & R.R. Mill RF1488
Kummerowia striata (Thunb.) Schindl. G, U, Ex, L RF2021
Lathyrus latifolius L. U, Ex RF3607
Lathyrus venosus Muhl. ex Willd. CNF, U RF3497
Lespedea bicolor Turcz. U, Ex RF2664
Lespedeza cuneata (Dum.-Cours.) G. Don G, U, Ex RF1911
Lespedeza frutescens (L.) Ell. RF2000
Lespedeza hirta (L.) Hornem. var. *hirta* G RF3621
Lespedeza intermedia (S. Watson) Britt. RF1910
Lespedeza repens (L.) Bart. U RF2008
Lespedeza violacea (L.) Pers. U RF3029
Lotus corniculatus L. Ex RF1269
Medicago lupulina L. U, Ex RF2246
Melilotus albus Medik. U, Ex RF1336
Melilotus officinalis (L.) Pall. Ex RF1193
Robinia hispida L. RF1952
Robinia psuedoacacia L. Sight
Securigera varia (L.) Lassen U, Ex RF3230
Trifolium aureum Pollich U, Ex, R RF2497
Trifolium campestre Schreb. Ex RF1330
Trifolium dubium Sibth. G, Ex RF1951
Trifolium pratense L. Ex RF1312
Trifolium repens L. Ex RF1195
Vicia caroliniana Walt. RF1889
Vicia sativa L. ssp. *nigra* U, Ex RF2434
Vicia villosa Roth ssp. *varia* (Host) Corb. Ex RF2435

Fagaceae
Castanea dentata (Marsh.) Borkh. TN, CNF RF1181
Fagus grandifolia Ehrh. Sight
Quercus alba L. G RF1942
Quercus coccinea Muenchh. G RF1963
Quercus montana Willd. G RF1897
Quercus rubra L. RF1052
Quercus velutina Lam. RF2006

Fumariaceae
Adlumia fungosa (Ait.) Greene ex B.S.P. TN, CNF 14146
Capnoides sempervirens (L.) Borkhausen TN, CNF RF2165
Dicentra canadensis (Goldie) Walp. RF0002
Dicentra cucullaria (L.) Bernh. RF0001
Dicentra eximia (KerGawl.) Torr. RF1127

Gentianaceae
Gentiana austromontana Pringle & Sharp CNF RF1700
Gentiana decora Pollard RF1904
Obolaria virginica L. U RF2085

Geraniaceae
Geranium carolinianum L. RF3058
Geranium maculatum L. RF1019
Geranium molle L. U, Ex RF2244
Geranium pusillum L. U, Ex RF2494

Hamamelidaceae
Hamamelis virginiana L. var. *virginiana* RF1109

Hydrangeaceae
Hydrangea arborescens L. RF1370

Hypericaceae
Hypericum densiflorum Lam. RF1252
Hypericum mutilum L. var. *mutilum* G RF2766
Hypericum prolificum L. RF4009
Hypericum punctatum Lam. RF1158
Hypericum stragulum W.P. Adams & N. Robson RF1492

Juglandaceae
Carya cordiformis (Wangenh.) K. Koch U RF1624
Carya glabra (P. Miller) Sweet RF3677
Carya ovalis (Wangenh.) Sarg. RF1585
Carya ovata (P. Miller) K. Koch U RF2668
Carya tomentosa (Lam. ex Poir.) Nutt. U RF1542
Juglans cinerea L. TN, CNF, U RF1920
Juglans nigra L. RF1980

Lamiaceae
Clinipodium vulgare L. Ex RF1345
Collinsonia canadensis L. RF1503
Cunila origanoides (L.) Brit. U RF3714
Glechoma hederacea L. Ex RF1029
Hedeoma pulegioides (L.) Pers. RF1613
Lamium purpureum L. U, Ex RF1030
Lycopus virginicus L. RF1727
Monarda clinopodia L. RF1603
Monarda didyma L. RF1453
Monarda fistulosa L. var. *fistulosa* G 15333
Monarda media Willd. U RF3596
Perilla frutescens (L.) Britt. U, Ex RF2624
Prunella vulgaris L. var. *vulgaris* Ex RF1454
Prunella vulgaris L. var. *lanceolata* (Bart.) Fern. RF2971
Pycnanthemum loomisii Nutt. RF2844
Pycnanthemum montanum Michx. RF1324
Pycnanthemum pycnanthemoides (Leavenw.) Fern. RF1899
Pycnanthemum tenuifolium Schrad. RF2700
Salvia lyrata L. Ex RF2240
Scutellaria elliptica Muhl. ex Spreng var. *elliptica* RF2353
Scutellaria elliptica Muhl. ex Spreng. var. *hirsuta* (Short & Peter) Fern. RF3372
Stachys cordata Riddell G RF2450

Lauraceae
Lindera benzoin (L.) Blume RF1025
Sassafras albidum (Nutt.) Nees. RF2009

Linaceae
Linum striatum Walt. G, U RF1491

Magnoliaceae
Liriodendron tulipifera L. Sight
Magnolia acuminata (L.) L. RF1380
Magnolia fraseri Walt. RF1055

Malvaceae
Tilia americana L. var. *americana* U, R RF2680
Tilia americana L. var. *heterophylla* (Vent.) Loundon RF3383

Menispermaceae
Menispermum canadense L. RF1162

Montiaceae
Claytonia caroliniana Michx. RF0006

Moraceae
Morus rubra L. U RF3918

Nyssaceae
Nyssa sylvatica Marsh. RF3160

Oleaceae
Forsythia viridissima Lindl. U, Ex, L RF2251
Fraxinus americana L. RF1212
Ligustrum sinense Lour. Ex RF1892

Onagraceae
Circaea canadensis (L.) Hill RF3658
Epilobium coloratum Biehler RF3030
Oenothera biennis L. G, U RF2697

Orobancaceae
Agalinus tenuifolia (Vahl) Raf. var. *tenuifolia* RF1648
Aureolaria laevigata (Raf.) Raf. RF1495
Conopholis americana (L.) Wallr. RF1233
Epifagus virginiana (L.) W. Bart. RF2745
Melampyrum lineare Desr. var. *americanum* (Michx.) Beauv. G RF2227
Pedicularis canadensis L. RF1082

Oxalidaceae
Oxalis grandis Small U RF1156
Oxalis montana Raf. RF1155
Oxalis stricta L. RF1294

Papaveraceae
Sanguinaria canadensis L. RF0016

Phrymaceae
Mimulus ringens L. var. *ringens* RF2663
Phryma leptostachya L. var. *leptostachya* RF2670

Phytolaccaceae
Phytolacca americana L. var. *americana* RF1270

Plantaginaceae
Chelone lyonii Pursh CNF RF2818
Gratiola neglecta Torr. G, U RF1096
Plantago lanceolata L. RF2232
Plantago rugelii Decne. U RF1357
Veronica anagallis-aquatica L. RF2258
Veronica arvensis L. Ex RF1992
Veronica hederifolia L. U, Ex RF2027
Veronica officinalis L. Ex RF2046
Veronica persica Poir. U, Ex RF2028
Veronica polita Fries U, Ex, R RF3511
Veronica serpyllifolia Poir. var. *serpyllifolia* U, Ex RF1031

Platanaceae
Platanus occidentalis L. RF3036

Polemoniaceae
Phlox paniculata L. G, U RF2705
Phlox stolonifera Sims RF1018

Polygalaceae
Polygala paucifolia Willd. RF1121

Polygonaceae
Fallopia convolvulus (L.) A. Löve U RF2281
Fallopia scandens (L.) Holub. RF3816
Persicaria longiseta (Bruijn) Kitagawa G Ex RF1267
Persicaria punctata (Ell.) Small U RF1975
Persicaria sagittata (L.) Gross ex Nakai U RF2949
Persicaria virginiana (L.) Gaertn. RF1452
Reynoutria japonica Houtt. Ex RF3919
Reynoutria sachalinensis (F. Schmidt ex Maxim.) Nakai RF2051
Rumex acetosella L. Ex RF1172
Rumex crispus L. ssp. *crispus* U RF2402
Rumex obtusifolius L. U, Ex RF1325

Portulacaceae
Portulaca oleracea L. U, Ex RF2841

Primulaceae
Lysimachia quadrifolia Sims RF3776
Lysimachia tonsa (Wood) Wood ex Pax & R. Knuth U RF2520

Ranunculaceae
Actaea pachypoda Ell. RF1154
Actaea podocarpa DC. G, U RF1592
Actaea racemosa L. RF1326
Anemone acutiloba (DC.) G. Lawson RF0010
Anemone quinquefolia L. var. *quinquefolia* L. U RF3077
Anemone virginiana L. var. *virginiana* RF2404
Clematis terniflora DC. Ex RF2969
Clematis virginiana L. RF1558
Ranunculus abortivus L. U RF2109
Ranunculus allegheniensis Britt. RF1032
Ranunculus bulbosus L. Ex RF2242
Ranunculus hispidus Michx. RF2293
Ranunculus recurvatus Poir. var. *recurvatus* RF2145
Thalictrum clavatum DC. G, U RF2216
Thalictrum coriaceum (Brit.) Small U RF2380
Thalictrum dioicum L. U RF1077
Thalictrum pubescens Pursh G RF3783
Thalictrum thalictroides (L.) Eames & Boivin RF0007
Trautvettaria caroliniensis (Walt.) Vail RF1177

Rhamnaceae
Ceanothus americanus L. RF2429

Rosaceae
Agrimonia gryposepala Wallr. G, U RF1555
Agrimonia parviflora Ait. RF2673
Agrimonia pubescens Wallr. U RF2612
Amelanchier arborea (Michx. f) Fern. RF3158
Amelanchier laevis Wieg. G RF1080
Aronia melanocarpa (Michx.) Ell. RF1131
Aruncus dioicus (Walt.) Fern. RF1201
Chaenomeles speciosa (Sweet) Nakai Ex RF2117
Crataegus coccinea L. RF2139
Crataegus macrosperma Ashe RF1709
Crataegus pruinosa (Wendl.) K. Koch var. *dissona* (Sarg.) Eggleston G RF3226
Fragaria virginiana Mill. RF1174
Geum canadense Jacq. G RF1377
Geum vernum (Raf.) Torr. & A. Gray U RF2121
Geum virginianum L. G, U RF2495
Gillenia trifoliata (L.) Moen. RF3322
Malus pumila Mill. Ex RF2106
Potentilla canadensis L. var. *canadensis* U RF3190
Potentilla indica (Andr.) T. Wolf Ex RF1353
Potentilla norvegica L. RF1552
Potentilla recta L. Ex RF1335

Potentilla simplex Michx. RF3255
Prunus pensylvanica L.f. RF1076
Prunus persica (L.) Batsch U, Ex RF2715
Prunus serotina Ehrh. var. *serotina* RF2105
Pyrus communis L. U Ex RF3055
Rosa multiflora Thunb. ex Murray Ex RF2767
Rubus argutus Link G, U RF3740
Rubus canadensis L. G RF1239
Rubus enslenii Trattinick RF3339
Rubus flagellaris Willd. RF3655
Rubus occidentalis L. RF3452
Rubus odoratus L. RF1166
Rubus pensilvanicus Poir. RF3458
Rubus phoenicolasius Maxim. U, Ex RF3178
Sorbus americana Marsh. G RF1132
Spiraea japonica L.f. U, Ex RF1360

Rubiaceae
Galium aparine L. RF1041
Galium circaezans Michx. G RF1580
Galium lanceolatum Torr. G RF1401
Galium latifolium Michx. U RF1183
Galium pedemontanum (Belliard) All. U, Ex RF3168
Galium tinctorium L. RF3592
Galium triflorum Michx. RF1217
Houstonia purpurea L. var. *purpurea* RF1157
Houstonia serpyllifolia Michx. RF1040
Mitchella repens L. RF1146

Salicaceae
Salix humilus Marsh. var. *humilus* U RF3373
Salix nigra Marsh. RF2951
Salix sericea Marsh. G RF1371

Santalaceae
Pyrularia pubera Michx. RF1576

Sapindaceae
Acer pensylvanicum L. RF1067
Acer rubrum L. Sight
Acer saccharum Marsh. var. *nigrum* (Michx. f.) Britt. RF1106
Acer saccharum Marsh. var. *saccharum* Sight
Acer spicatum Lam. RF1521
Aesculus flava Solander RF1105

Saxifragaceae
Astilbe biternata (Vent.) Britt. RF1200
Chrysosplenium americanum Schwein. ex Hook. CNF RF0020
Heuchera americana L. RF3325
Heuchera villosa Michx. var. *villosa* RF2687
Hydatica petiolaris (Raf.) Small U RF3185
Micranthes micranthidifolia (Haw.) Small G RF1050
Mitella diphylla L. RF3051 *Tiarella cordifolia* L. RF1039

Scrophulariaceae
Verbascum thapsus L. Ex RF1998

Simaroubaceae
Ailanthus altissima (Mill.) Swingle Ex RF1404

Solanaceae
Physalis heterophylla Nees G RF3462

Ulmaceae
Ulmus americana L. RF4035
Ulmus rubra Muhl. RF1896

Urticaceae
Boehmeria cylindrica (L.) Sw. U RF1502
Laportea canadensis (L.) Wedd. RF1176
Pilea pumila (L.) A. Gray U RF2017

Verbenaceae
Verbena urticifolia L. RF1456

Violaceae
Viola affinis Le Conte Ex RF4018
Viola bicolor Pursh RF2042
Viola blanda Willd. RF1005
Viola canadensis L. var. *canadensis* RF2059
Viola cucullata Ait. RF1073
Viola hastata Michx. RF0024
Viola palmata L. RF2168
Viola pedata L. var. *pedata* U RF2170
Viola pensylvanica Michx. RF0004
Viola pubescens Ait. U RF2047
Viola rostrata Pursh RF1028
Viola rotundifolia Michx. RF1202
Viola sagittata Ait. var. *ovata* (Nutt.) Torr. & A. Gray U, L RF1231
Viola sagittata Ait. var. *sagittata* L. U RF1112
Viola sororia Willd. G RF1128
Viola striata Ait. RF0003
Viola subsinuata Greene RF3124

Vitaceae
Parthenocissus quinquefolia (L.) Planch. RF2606
Vitis aestivalis Michx. var. *aestivalis* G, U RF2184
Vitis aestivalis Michx. var. *bicolor* Deam G RF2526
Vitis vulpina L. U RF1618

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